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VOL. LVI, No. 1460

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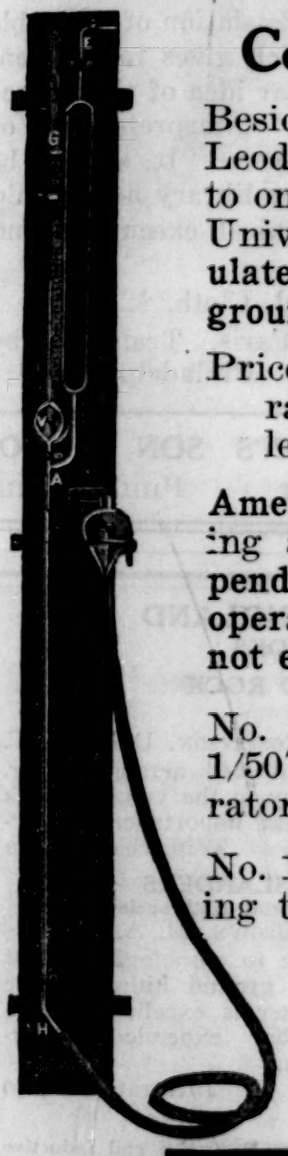

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SCIENCE

VOL. LVI DECEMBER 22, 1922 No. 1460

The Whitney South Sea Expedition of the American Museum of Natural History: ROBERT CUSHMAN MURPHY 701

A Menace to the National Parks: DR. W. G. VAN NAME 705

The American Association for the Advancement of Science: The Medical Sciences; The History of Science; The Social and Economic Sciences; Railway Tickets to Boston 707

Scientific Events: Louis Pasteur; The Frank Nelson Cole Prize in Algebra; Colloid Symposium at the University of Wisconsin; Grants from the Bache Fund 710

Scientific Notes and News 712

University and Educational Notes 715

Discussion and Correspondence: Radiation a Form of Matter: PROFESSOR ARTHUR H. COMPTON. *Russian Scientific Aid:* DR. VERNON KELLOGG 716

Scientific Books: Noyes's "Watchers of the Sky": PROFESSOR ERNEST W. BROWN 717

Special Articles: Iodine and Anuran Metamorphosis: PROFESSOR W. W. SWINGLE 720

The American Chemical Society: DR. CHARLES L. PARSONS 722

The American Mathematical Society: PROFESSOR R. G. D. RICHARDSON 730

Science News ..... *Supplement*

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THE WHITNEY SOUTH SEA EXPEDITION OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THROUGH the personal influence of Dr. Leonard C. Sanford, a trustee and honorary fellow of the American Museum of Natural History, Mr. Harry Payne Whitney agreed in 1920 to finance a zoological expedition in Polynesia. The main object of the expedition is to collect birds at the various islands of the South Sea and on the intervening ocean areas. The sum generously contributed by Mr. Whitney was considered sufficient for five years' work, including provision for the purchase of a vessel which would assure the field workers of the Museum an opportunity to visit a large number of islets which are far from the trade routes or ordinary lines of communication. The expedition is perhaps the most comprehensive that has ever been planned and equipped for ornithological science.

The Whitney South Sea Expedition is under the direct administration of a committee appointed by the Trustees of the Museum and consisting of Doctors Leonard C. Sanford, Frank M. Chapman and Robert Cushman Murphy. As field representative, the Museum has been fortunate in securing the services of Mr. Rollo H. Beck of San José, California, a veteran naturalist and collector of marine birds who had previously rendered the institution years of noteworthy service, particularly while he was in charge of the Brewster-Sanford South American Expedition of 1912-1916. Mr. Beck is accompanied in the field by Mrs. Beck, who was his constant companion during the South American littoral work, and by an assistant, Mr. Ernest H. Quayle, whose training at Stanford University has admirably fitted him for the responsibility. In September, 1920, the members of the party sailed from San Francisco to Tahiti and from the latter base they have

since been engaged uninterruptedly in field work.

An appeal by Professor Henry Fairfield Osborn, president of The American Museum of Natural History, to Ambassador Jusserand for the good offices of the French Government in the Society Islands, met with a generous reponse, and since the initiation of the work, the Whitney Expedition has received every courtesy both from the government and from individuals at the French Islands.

When Messrs. Beck and Quayle arrived in Tahiti, they began at once an ornithological reconnaissance of this classic isle. As opportunity offered, trips were made to neighboring islands either upon trading vessels or by the use of sloops carrying copra or other cargoes. Early in 1921 an invitation from Père Rougier, the proprietor of Christmas Island, north of the Equator, was accepted, and the ornithologists made a notable journey to this interesting station, stopping en route for collecting at three different islands of the Marquesas group. Subsequently voyages were made to the southward, when the northern islands of the Austral group were visited, as well as Rapa, the southernmost of the eastern Polynesian islands. In September, 1921, a second trip was made to the Marquesas, followed by a preliminary visit to the Tuamotu Archipelago, upon eleven islets of which collecting was undertaken.

During the first year's work, Mr. Beck was continually on the lookout for a suitable vessel which he might purchase, and in this way become independent of the uncertain movements of trading craft. In December, 1921, after adverse consideration of several vessels, the Committee purchased the 75-ton schooner "France," which is equipped with a sixty horse power engine and which was built at Tahiti three years ago. Through the unfailing courtesy of the French Colonial Government, the usual requirement of partial French ownership was waived, and the schooner was admitted to yacht registry, with permission to carry on work at any of the French islands. Similar permission for the British islands was granted by His Majesty's Colonial officers, and after the "France" had been thoroughly refitted, she sailed with Messrs. Beck and Quayle, in Jauuary, 1922, on a trip to the Austral Islands, Rapa, Gambier Islands, Pitcairn, Henderson, Oeno, Elizabeth and Ducie Islands.

While the expedition is primarily ornithological, no opportunity has been lost to obtain desirable material and data in other branches of science, particularly at the many Polynesian islands where the native peoples and fauna are rapidly dying out or are altering materially with changing conditions. With this object in mind, the Museum has cooperated in all possible ways with other institutions that are carrying on research in the Pacific. The Bernice Pauahi Bishop Museum of Honolulu, for example, is now a center of Pacific investigations, coordinated under the administration of Professor Herbert E. Gregory, of Yale, who is serving as Director of the Bishop Museum. The Committee of the Whitney Expedition has been from the beginning in close touch with Professor Gregory and has sought his advice on many details. The members of the Expedition have been instructed to undertake special lines of collecting which do not interfere with their main objects, to offer transportation whenever possible to the field workers of the Bishop Museum, and of other scientific organizations, and in general to further the cause of Pacific investigation by selecting fields of endeavor which lead toward cooperation rather than competition. It has been decided, for instance, to leave the ornithological investigation of the Hawaiian Islands and of certain neighboring groups, such as Midway, Johnston, Palmyra and Washington Islands, to the Bishop Museum, and to confine the efforts of the Whitney Expedition, for the present at least, to the southerly and easterly islands of Polynesia, from Samoa and the Marquesas southward and eastward to the Austral group and Easter Island. In order that the American Museum of Natural History may obtain a full representation of the avian fauna of the Pacific Basin, however, a comprehensive exchange of material has been arranged, and the museum has already received from Honolulu an important collection of Hawaiian birds, which gives it a very nearly complete series of the scarce or ex-

tinct *Drepanididæ* as well as other interesting and peculiar birds of the archipelago.

In addition to the advisory services of Professor Gregory and his staff, and of many other friends of the American Museum, the expedition has enjoyed the cooperation of Dr. Charles W. Richmond, of the United States National Museum, in the preparation of abstracted data of great value for any research in Polynesia. Dr. Richmond, who is a distinguished bibliophile, has a rare acquaintance wtih geographical works relating to the Pacific, particularly with the accounts of both early and recent voyages in this field. Upon the basis of his experience and his bibliography, Dr. Richmond has summarized the principal points of geographic and zoological interest in the writings of discoverers, naturalists, travelers, missionaries, and others who have visited the Line, Marquesas, Society, Cook, Austral, Tuamotu, and more easterly groups. Dr. Richmond's manuscript report gives, moreover, all the known synonyms of the names of the various islands and their outliers. His data on this score are based upon hundreds of sources and are far more complete than the list of designations given in the pilot books or atlases. The report also includes a full list of the known vertebrate fauna of each island, with notes on all the extinct, doubtful or mythical species mentioned by the early voyagers. Equipped with such information, the Museum's field workers are in a position to investigate each island with a full knowledge of what they may expect or hope to find.

Emphasis should be laid upon the fact that zoological investigation in Polynesia must be done now if it is to be done at all. Extinction of the native animals has long been in progress. The introduction of pigs, dogs, cats, and even of the mongoose, into islands which had no native mammalian fauna; the rapid spread of the alien minah and weaver birds, and of a hawk transported from Australia; and the periodical concentration of copra workers, or of pearl or bêche-de-mer fishermen, upon small islets, make it certain that many of the native birds are doomed as surely as the splendid race of native people. Dr. Richmond's report has not failed to call attention to the importance of the rapid completion of such work as the Museum has now undertaken. Some idea of the extraordinary changes taking place in Polynesia may be gained from the following press quotation referring to an islet of the Tuamotus:

"The opening of the pearl diving season, the great event of the year in the French settlements, comes in July. Diving is not permitted for two years in succession at the same island. The various pearl islands are opened in rotation. This means that all gear, stocks of merchandise and building material must be taken to a new island each year—no small undertaking when it is remembered that the coral atoll, which in ordinary times supports less than 200 persons, becomes in the diving season the abiding place of 2,500 or more. This year the open island is Hikueru, one of the Paumotu archipelago 400 miles to the eastward of Tahiti. Already this lonely atoll is taking on a metropolitan appearance. The profits to be gained come not only from the pearl-shell won from the lagoon, but from the sale of all kinds of wares dear to the native heart and from the providing of entertainment to refresh the weary diver and his women folk after the labors of the day are over. The average native diver wins a good sum from the bottom of the lagoon and much of it goes on expensive silk dresses for his wife and daughters, on the delectable canned goods of the "popaa" (white man) and on the "movies." This year there are to be, it is said, three moving pictures theaters, any number of motor cars for hire—the length of the roadway in Hikueru is less than a half mile, but that apparently does not make any difference—a brass band and, it is reported, electric lights along the "Great White Way" of this little ring of coral sand. Late advices indicate that the season this year at Hikueru will be the most active in many years. It is estimated there will be at least 1,000 divers at the island. These, together with their families and the traders with their staffs, will swell the population of the island during the season to nearly 4,000."

The collecting work of the Whitney South

Sea Expedition has no more than fairly begun, but the specimens already received at the Museum have given a foretaste of the remarkable zoological and geographical results that are to be anticipated. The material comprises the following:

1. More than 3,000 bird skins, together with representative collections of birds preserved in alcohol, nests and eggs, and the stomachs of specimens prepared as skins. The contents of the bird stomachs are to analysed and reported upon by members of the staff of the United States Biological Survey.

2. A collection of reptiles, including lizards from nearly all the islands visited, as well as marine turtles. Although the lizards are represented by but a small number of species, the aggregation constitutes one of the few collections sent to the United States from Polynesia since the days of the Wilkes Expedition of 1828-1834. A duplicate set of reptiles has been forwarded to the Bishop Museum.

3. Herbarium collections made by Mr. Quayle at the Society Islands, Austral Islands and elsewhere. The plant specimens have, for the most part, been sent to the Bishop Museum for determination, only one set of duplicates being retained in New York.

4. Photographs illustrating not only the birds and other wild animals of the places visited, but also interesting features of the topography, vegetation and the appearance and life of the native peoples.

5. Approximately 3,500 pages of manuscript notes, prepared by Messrs Beck and Quayle, which not only supply a narrative of the expedition, and a running comment upon the ornithological field work, but also throw light upon many phases of Polynesian life conditions.

The birds received from the Whitney South Sea Expedition demonstrate that Polynesia is one of the greatest remaining fields for ornithological investigation. They comprise thus far about a hundred forms, of not more than twenty-five families, but they are all represented in splendid series, and some of them are among the rarest of known birds. Several of the species were, in fact, listed in Rothschild's monograph on "Extinct Birds" (1907). Many of them are of much historic importance in that the status of the species has heretofore rested entirely upon descriptions dating from the golden age of exploration, when Bougainville, James Cook, and other discoverers, brought back to Europe the first collections from Polynesia. The warbler (*Conopoderas æquinoctialis*) of Christmas Island, for example, has not heretofore been represented in any collection, and was known only from the faulty description of Latham. The beautiful fruit pigeon (*Ptilopus huttoni*) of Rapa had previously been known only from the type skin in the Museum at Turin; and there are many other examples. Finally, a relatively large proportion of the birds obtained prove to be new to science.

The sea birds, as well as many of the insular land birds, of Polynesia, throw much light upon broad questions of geographical distribution. The collections of the Whitney Expedition show, for instance, that the birds of the tropical trade wind belt in the South Pacific are, for the most part, specifically or racially distinct from those inhabiting the Horse Latitudes farther south. The terrestrial avifauna is not particularly extensive, but it proves highly interesting. As an example, the warblers of the genus *Conopoderas* appear to exhibit on a vastly larger scale the evolutionary facies of the Galápagos finches. Each large insular group in Polynesia seems to have its peculiar species of this genus, while in some cases every islet within a single archipelago has a well-marked geographic race, the range of which may not be greater than the isolated surface of but a few acres.

Since Mr. Beck left the United States he has from time to time sent home narrative accounts of great general interest, which have been published in "Natural History," the Journal of the American Museum. At the present time Messrs. Beck and Quayle are working from the "France" among the Marquesas Islands, whence additional reports and shipments of material are expected early in 1923.

ROBERT CUSHMAN MURPHY

A MENACE TO THE NATIONAL PARKS

THROUGH its representation on a committee entitling itself the "National Parks Committee," the American Association for the Advancement of Science and all of its members have been placed in the position of endorsing and promoting the Barbour Roosevelt-Sequoia Park Bill (H.R. 7452) now before the House of Representatives. This bill has good prospects of being passed by the present Congress.

Much inquiry and correspondence have shown that the greater part of the support of this measure has been obtained without those giving it understanding what the bill will do, as they hold the erroneous idea that the bill is practically the same as the excellent Roosevelt Park measure which failed to pass the last Congress. It therefore seems important to call attention to the destructive character of the Barbour Bill.

The following resolution regarding it, passed on September 9 last by the San Diego Natural History Society, located in the same region as the Sequoia Park, and one of the most prominent scientific associations of the west, deserves the serious consideration of all scientific men and conservationists.

Whereas, The Barbour Roosevelt-Sequoia Park Bill (H.R. 7452), now before Congress, contains, as one of its provisions, the relinquishment by the National Park Service of about half of the present Sequoia Park, in exchange for extensive, mainly untimbered, tracts in the higher mountain region.

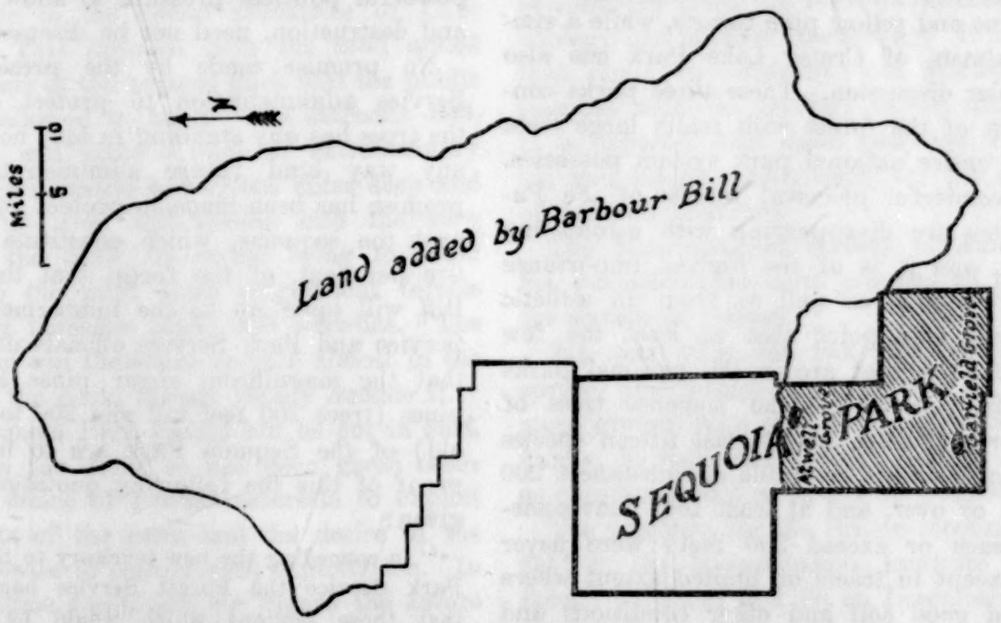
And whereas, The tract relinquished will, under the provisions of this bill, pass under the jurisdiction of the Forest Service, with the avowed object of permitting the cutting of much of the standing timber,

And whereas, This tract contains about one third of the total number of giant sequoias contained in the entire park, together with forests of other majestic trees which are now rapidly disappearing,

And whereas, None of those who are now publicly supporting the Barbour Bill defend this division of the present Sequoia Park, and the sacrifice of a large part of its area, except as a compromise by which other valuable scenic territory is to be acquired,

And whereas, This compromise is known to be the outcome of a factional dispute and a competition for jurisdiction between the National Park Service and the Forest Service,

And whereas, As a result of such internecine strife on the part of those who should be defending the interests of the public, the country will lose for all time large areas of primeval forest which should be preserved for recreation, for esthetic enjoyment, and for scientific study,



Map showing effect of the Barbour Bill in cutting off the southern half of the present park, also the deep bay in the proposed western boundary which will permit commercial exploitation of timber lands almost in the center of the area added.

And whereas, Such a violation of the integrity of our national park system sets an extremely dangerous precedent, and gives heart to those interests which are continually striving to invade the public domain and to destroy our natural scenery for the gratification of purely selfish ends, therefore,

Be it resolved, That the San Diego Natural History Society strongly opposes the Barbour Bill, in its present form, as being a serious blow to our national park system and to the principle of conservation in general, and that it advises the amendment of this bill so as to exclude its provision for the relinquishment of any portion of the present Sequoia Park, while retaining its constructive features, according to which large tracts of high scenic value would be added to the present park.

Be it further resolved, That copies of this resolution be sent to the two senators from California, and to the congressman representing this district; as well as to such organizations as may seem appropriate to the society's conservation committee.

Designs on the fine forests of the national parks are not confined to those of the Sequoia Park. A shifting back of the western boundary of the Yosemite Park is recommended by the director of national parks in his report for 1921 (page 72), and if carried out as there recommended, would eliminate from that park all its three sequoia groves and most of its magnificent sugar pine and yellow pine forests, while a similar treatment of Crater Lake Park has also been under discussion. These three parks contain most of the forest with really large trees that the entire national park system possesses.

The wonderful primeval forests of the Pacific states are disappearing with astonishing rapidity, and it is of the highest importance from a scientific as well as from an esthetic and scenic standpoint that at least the few tracts of them that are in the national parks should be preserved. The immense trees of these forests (there are at least fifteen species that become under favorable circumstances 200 feet tall or over, and at least four that sometimes reach or exceed 300 feet) were never found except in tracts of limited extent where they had good soil and other conditions and had escaped serious fire damage for long periods. Those few that still survive are mainly in the hands of the lumber interests and a few years will see the last of them.

We must not be deceived by the assertion that the forests now in the parks "will be just as safe in the hands of the Forest Service as in the Parks." The totally different purposes of the Park Service and Forest Service bureaus should not be lost sight of in judging of the results of such a transfer. The parks are required to be maintained in as nearly as possible their natural, wild state. The lands under Forest Service control are managed from a purely commercial standpoint to produce as much lumber as possible, the trees being sold and cut when mature and all esthetic, scientific or other considerations being subordinate to that of dollars and cents. This policy is the right and necessary one for the greater part of the national forests, but for areas that are parks, or will in the future be needed for parks, it is fatal. The folly and danger of subjecting things that should be preserved permanently in their natural state to a bureau conducted for purely practical and commercial purposes and officered by men who by training, association and interests see in the wonderful trees of the Pacific states only so many feet of lumber, or so many cross ties, and who moreover will be subjected to constant and powerful political pressure to allow their sale and destruction, need not be discussed.

No promise made by the present Forest Service administration to protect certain of the trees has any standing in law, nor can it in any way bind future administrations. No promise has been made to protect anything except the sequoias, which constitute less than five per cent. of the forest that the Barbour Bill will open up to the lumbermen. Forest Service and Park Service officials do not deny that the magnificent sugar pines and yellow pines (trees 200 feet tall and 200 to 500 years old) of the Sequoia Park are to be cut. In proof of this the following quotations may be given:

"In conceding the new territory to the National Park Service the Forest Service has contended that those sections which would be eliminated from the present Sequoia National Park are required *for the commercial needs of that section*

of California; that is, for grazing purposes *and for timber* other than the big sequoia trees, which will always be preserved." (From a letter by A. B. Cammerer, acting director National Park Service, to H. S. Watson, of date May 19, 1922).

"The transfer of the three townships now in the park is not particularly *with the avowed object* of permitting the cutting of much of the standing timber. As a matter of fact, the timber resources do not anywhere nearly compare in value with those upon other national forest lands readily available for purchase but for which no demand has yet arisen. Some small cuttings might be necessary to supply local needs, and *ultimately good silvicultural practice would require the harvesting of the mature timber.* There is no probability that the timber will be sold or even in demand for some time to come." (From letter from L. F. Kneipp, assistant forester U. S. Forest Service, to C. G. Abbott; date October 2, 1922).

That the park as provided for by the Barbour Bill will contain little in the way of forests, we have the assurance of the chief of the Forest Service who in addressing the Public Lands Committee of the House of Representatives at the hearing on the Barbour Bill, December 13, 1921, said, "Aside from the giant forests [the sequoia groves] the areas of commercial timber remaining within the area are of *negligible extent* and of negligible future importance to the forest industries of California." This includes both the land added and the part of the present park that the public is to be allowed to keep. The Barbour Bill, moreover, will make a park of extraordinary shape. An immense bay fifteen miles deep and many miles wide will extend into the very heart of the park, its object being to avoid adding to the park some magnificent forests containing immense pines and sequoias. The lumbermen can therefore operate almost in the center of the park, though legally outside it.

The Sequoia Park should not be cut in half. No reason for doing so has been given other than the desire of private interests to exploit the forests of the park and the desire of the Forest Service to control such exploitation. In view of these facts, can we regard the severe condemnation of the measure expressed in the San Diego Society's resolution as unwarranted? Should not its protest be backed up by every scientific association and every organization interested in real conservation?

W. G. VAN NAME

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE MEDICAL SCIENCES

FOR a number of years Section N has held a symposium on subjects of outstanding interest to medical and allied workers. There were symposiums on "Growth and Development of the Child"; "Medical Lessons of the War"; "Ductless Glands"; "Growth Problems," etc. Each of these symposia was an invitation program.

These meetings were extraordinarily well attended, always taxing the capacity of the large halls provided for the meetings. They met a real and large demand on the part of the members of the section, the members of the association, and the non-members in the fields of public health, medicine, bacteriology, etc. The section committee, after mature deliberation, has decided that the section could be more useful by changing its policy. It has decided, beginning with the Boston meeting, to hold a symposium to which will be invited representatives from the fields of medicine, parasitology and medical entomology. It is planned that each representative will discuss his researches with the workers in the allied fields. It is expected that these meetings will afford the long-sought opportunity for the discussion of common problems.

The Entomological Society of America and the Parasitologists have planned to meet with the section at Boston.

The new plan has met with such a widespread and strong response that it is hoped more groups may join with the section in the future, to make the annual meeting as broad, as significant and as useful as possible.

The program for the Boston meeting is to be held in the Massachusetts Institute of Technology buildings at 1:30 on December 29. The program is as follows:

Professor A. B. Macallum, retiring vice-president of Section N, McGill University, Montreal:

"The necessity for advanced research on the intestinal mucosa, the great gateway of disease of the body" (vice-presidential address).

C. T. Brues, Bussey Institution, Harvard University: "Is poliomyelitis an insect borne disease?"

C. A. Kofoid, University of California: "Incidence of the human intestinal protozoan infections in the United States."

Richard P. Strong, Harvard University: "Some aspects of disease associated with the fields of zoology, entomology and parasitology."

C. W. Stiles, U. S. Public Health Service: "Some medico-zoological phases of our immigration problems."

L. O. Howard, U. S. Bureau of Entomology: (Title to be announced).

The secretary desires an expression of opinion from all interested workers, and extends to them an invitation to attend.

A. J. GOLDFORB,
Secretary of Section N

THE HISTORY OF SCIENCE

AT the Boston meeting of the American Association for the Advancement of Science from December 26 to 30, the development of science is to be recorded in more than one aspect. The members of the association will be given an interesting opportunity to learn of the value of historical introspection of scientific thoughts in terms of progress. Also some attempt will be made to discuss the meaning and philosophy of the idea of this progress.

Section L (of which the History of Science is a part) is the youngest of the sections formed within the American Association, and will hold its third meeting on December 27.

The first meeting of those interested in the field of the history of science was held with the American Association for the Advancement of Science in Chicago, December, 1920. At this time plans of organization were formulated. At the Toronto meeting in December, 1921, the organization became a more definite reality. Consequently the Boston gathering of the history of science group will be the second official meeting.

The progress of the interest in the history of science has been growing constantly. Not alone has this been manifested among the scientists, but with the historians as well. The value of the study of the history of science is thus greatly emphasized by being cultivated by two distinct bodies of scholars.

Therefore, at the Boston convocation of scientists the program for the history of science meeting will be presented by two different groups, namely, Section L and the group interested in the history of science from the American Historical Association.

On Wednesday, December 27, at 2 P.M., Section L will present its program with the following speakers: Dr. Florian Cajori, University of California; Dr. H. W. Tyler, Massachusetts Institute of Technology; Dr. George Sarton, Carnegie research associate; Dr. William A. Locy, Northwestern University, also chairman, and the association's vice-president for Section L, with two other scholars active in the history of science movement, to be named later.

On Thursday, December 28, at 2 P.M., the joint conference with the history of science group from the American Historical Association will be held. The following is the program:

Chairman: Dr. James Harvey Robinson, New School for Social Research, New York City.

"The origin of ideas": The chairman of the conference."

"Some psychological and social conditions of the scientific attitude of mind": Dr. George H. Mead, University of Chicago.

"The historical background of modern science": Dr. Lynn Thorndike, Western Reserve University.

"Science in the thirteenth century": Dr. George Sarton, Carnegie research associate.

"What science has contributed to people's thinking about life and destiny": Mrs. Mary Hunter Austin, New York City.

General discussion, opened by William A. Locy, Northwestern University, chairman of Section L.

FREDERICK E. BRASCH,
Secretary of Section L

THE SOCIAL AND ECONOMIC SCIENCES

THE program of the section of Social and Economic Sciences at the Boston meeting will deal with problems of the development and

conservation of natural resources. The aim is to present the economic background of conservation as related to certain of our resources. An immense amount of misapprehension exists about conservation and the measures that have been proposed to secure a better handling of our resources. The scientific men of the country can perform a public service by furnishing the facts regarding our different resources and their relation to the upbuilding of the nation. To bring out such facts, so far as the limitations of the meeting will permit, is the purpose of the symposium to be presented at Boston.

The most precious resource of any nation is a virile, intelligent and healthy population. The conservation of health, of the energy and the working power of the people constitutes the theme of the morning session on December 27. Papers will be presented by Dr. T. S. Baker, of Pittsburgh, Mr. W. F. Chamberlain, of Hartford, and Dr. E. R. Kelley, of Massachusetts.

A second topic closely allied with the foregoing is the building up and maintaining of a strong rural civilization. Problems relating to the home and to home life and to conserving the qualities of the rural population are of great importance. The questions of home economics and of country life, as well as of land settlement under present conditions, will be discussed on the afternoon of December 27, when Section K meets with the Section on Agriculture. The program includes the names of President Kenyon L. Butterfield, of Amherst, Dr. C. F. Langworthy, Dr. Helen W. Atwater and the Honorable F. H. Newell, of Washington.

Forestry is the subject of the session on the morning of December 28, which will be in conjunction with the New England Forestry Congress. There will be brought out some of the important economic facts that call for a vigorous national policy of forestry. The chief forester, Colonel W. B. Greeley, and a prominent member of his staff, Mr. Raphael Zon, will present papers on the national and on the international problems of our timber supplies. Professor R. T. Fisher, of Harvard University, will discuss certain aspects of forest research, and the state forest commissioner of Massachusetts, Mr. Bazeley, will speak on the subject of a state forest policy.

A series of special topics relating to the conservation of capital and credit and the reduction of waste in industry will form the program in the afternoon of December 28. Mr. H. T. Newcomb, of New York, Dr. R. H. Halsey, of New York, Dr. Frederick L. Hoffman, dean of the advanced department of Babson Institute, Dr. F. B. Gilbreth and Mr. James G. Dudley, of New York, are the speakers.

The session on the morning of the twenty-ninth will be a joint meeting with the Section of Engineers. Problems relating to water resources, power development and flood control will be the general subject, with papers by General Harry Taylor, U. S. Army; Mr. William S. Murray, of New York; Mr. O. C. Merrill, of Washington, and Dr. John T. Black, of Hartford. The conservation of our scenic resources and of wild life constitutes the topic of the session on the afternoon of December 29. The national park problems, with special reference to the present efforts to open them up to commercial use will be discussed by Mr. Robert S. Yard, of Washington. Dr. G. F. Kunz, of New York, will present certain aspects of the practical service of the scenic resources to the public. The conservation of our whale fisheries will be the subject of a paper by Dr. John F. Crowell, of New York.

The chairman of the sessions will be the vice-president for the section, Professor Henry S. Graves, of Yale University. The retiring vice-president is Professor James W. Mavor, of the University of Toronto, who will present on the first day an address on "Certain economic reactions of the war."

The meetings of Section K will for the most part be in Pratt Building, Massachusetts Institute of Technology.

RAILWAY TICKETS TO BOSTON

THOSE who are to attend the approaching Boston meeting of the American Association

for the Advancement of Science will have the benefit of reduced railway rates, as has been previously announced. The reduced rate of a fare and a half for the round trip has been granted by the railway associations representing almost all of the United States and Canada. Those intending to go to Boston for this meeting should state to their local railway agents that they are to attend the Boston meeting of the American Association for the Advancement of Science. They should purchase a single, full fare, one-way ticket to Boston and should secure from the agent a standard certificate. A receipt is not needed. On arrival at the meeting railway certificates are to be deposited at the validation desk in the registration room at the Massachusetts Institute of Technology. A card identifying the certificate will be given out and is to be returned when the certificate is reclaimed. In the meantime, endorsement and validation of the certificates that have been deposited will be cared for. After endorsement and validation the certificate is to be presented at the railway ticket office in Boston and the agent will allow each holder of a certificate to purchase a continuous return trip ticket from Boston to the place of starting, at one half of the regular fare.

It is not necessary for those intending to go to Boston to present to the railway agent when they purchase their tickets any credentials as to membership in the association or societies. Certificates will be endorsed by the American Association for the Advancement of Science for all association members in good standing and also for members of associated societies meeting with the association in Boston, whether or not the latter are also members of the association. Any person having the right to have his certificate validated may also have certificates validated for personal guests, this being limited to members of his immediate family, not including men over twenty-one years of age. Those who have certificates for validation and are not members of the association or societies, nor delegates, nor personal guests, should become associates for the Boston meeting, if they do not care to become members. As all readers of SCIENCE know, a new member pays an entrance fee ($5) and the first annual dues ($5), while an associate pays the associate fee only ($5). As far as the validation of railway certificates is concerned, associates are to be treated like members in good standing, and members of associated societies meeting with the association are to be treated in the same way.

SCIENTIFIC EVENTS

LOUIS PASTEUR

AT the December meeting of the Syracuse chapter of Sigma Xi the following resolutions were adopted:

Whereas, On December 27, 1922, will occur the centenary of the birth of Louis Pasteur, whose life was characterized by tireless industry and preeminent achievement in research; and

Whereas, These researches conducted on lines of pure science have found remarkable application in many departments of economic and social betterment, culminating in the largest advances in measures of sanitation and consequent conservation of human life; and

Whereas, The unsparing devotion of his life to these ends is a challenge and an inspiration to highest emulation; therefore

Resolved, That the Syracuse Chapter of Sigma Xi record its high esteem and appreciation of these epoch-making discoveries in pure and applied science, and the life of noble devotion thereto;

Resolved further, That with hearty acclaim we join the innumerable company of many lands who gratefully participate in the commemoration of the centenary of his birth and the masterful and enduring achievements of his life.

THE FRANK NELSON COLE PRIZE IN ALGEBRA

At the time of the retirement, in December, 1920, of Professor F. N. Cole as secretary of the American Mathematical Society and editor of its *Bulletin,* a sum of money was collected from members of the Society by a committee, of which Professor H. S. White was chairman, and was presented to Professor Cole in recognition of his distinguished services through a period of twenty-five years. At the next meeting of the Council, Professor Cole donated this fund to the Society, to be used as the Council might think best. The committee, consisting of

Professors Frank Morley (chairman), T. S. Fiske, and H. S. White, which was appointed at that meeting to make recommendations to the council as to the use of the income of this fund, has presented a report recommending that this fund shall be used to endow a prize, to be called the Frank Nelson Cole Prize in Algebra. The recommendations of this committee, which were accepted by the council at its meeting in October, 1922, follow below:

1. The fund shall accumulate until by interest and contributions it reaches the amount of one thousand dollars.

2. At the end of every five years thereafter the Council shall award from the available income not more than two hundred dollars as a prize for the best memoir offered in competition upon some question in the theory of Galois groups, or the theory of numbers, or some other part of algebra.

3. The question or subject for competitive memoirs shall be announced by the Council at least two years in advance of the date for their submission; and the details of the mode of award shall be published at the same time.

4. The prize shall be designated as the Frank Nelson Cole Prize in Algebra. At the time of each award the names of all previous recipients of the prize shall be published in the *Bulletin* of the Society, together with the name of the successful competitor and an abstract of his memoir.

5. The prize may be withheld at the end of any quinquennium if no sufficiently meritorious memoir be submitted; and in such case a double prize may be awarded in the next following quinquennium.

6. These conditions may be altered at any time by a two-thirds vote, in writing, of all members of the Council.

R. G. D. RICHARDSON,
Secretary.

COLLOID SYMPOSIUM AT THE UNIVERSITY OF WISCONSIN

THE most important colloid symposium yet held in America will take place at the University of Wisconsin next June from the twelfth to the fifteenth. On this occasion the university will be host to a group of the leading colloid chemists of the country, who will present papers on their specialties and indulge in unusually full discussion. The university will publish the proceedings in adequate form. The whole symposium is in honor of Dr. Thé Svedberg, of the University of Upsala, who will give colloid instruction at Madison during the entire second semester and during the summer. Among those who have already announced their intention of presenting papers are Drs. Jacques Loeb, S. E. Sheppard, R. E. Wilson, Jerome Alexander, Martin H. Fischer, J. H. Matthews, Wilder D. Bancroft, Harry N. Holmes, F. E. Bartell, Gortner, Bogue, E. B. Spear, Hugh Taylor, Weiser, Burton and J. A. Wilson. Every one interested in colloids is cordially invited to come. Time will be allowed for sports and social recreation. This symposium is strongly endorsed by the Colloid Committee of the National Research Council.

HARRY N. HOLMES,
Chairman Committee on Colloids
OBERLIN, OHIO

GRANTS FROM THE BACHE FUND

GRANTS from the Bache Fund of the National Academy of Sciences have been made as follows:

$200 to Professor N. E. Wheeler, Colby College. For a study of the relationship of electrical conduction in concentrated solutions.

$300 to Professor Gregory P. Baxter, Harvard University. For the determination of the atomic weights of arsenic, titanium and germanium.

$600 to Dr. W. H. Taliaferro, Johns Hopkins University. For the study of the variability and inheritance of size in different species of Trypanosoma.

$500 to Professor L. L. Woodruff, Yale University. For a study of the significance of endomixis and of fertilization in the life history of Infusoria.

$250 to Professor Roger Adams, University of Illinois. For the study of the oxides of platinum, palladium and iridium as catalysts.

$400 to Dr. Keivin Burns, Allegheny Observatory. For the determination of wave lengths of standard lines in the solar spectrum in reference to the cadmium and neon standards.

$100 to Professor Otto F. Kampmeier, University of Illinois. For a monograph on the evolution and comparative morphology of the lymphatic system of vertebrates.

$650 to Professor R. R. Renshaw, New York University. For a study of the basis for the

physiological activity of substitutes of the choline type.

$400 to Professor H. I. Schlesinger, University of Chicago. For an investigation of the absorption spectra of inorganic compounds, particularly the oxides of sulphur and the compounds obtained by the interaction of certain salts with nitric oxide.

Applications for grants will next be considered in April, 1923, and should be filed, together with endorsements, with the chairman of the board, Professor Ross G. Harrison, Osborn Zoological Laboratory, Yale University, New Haven, Connecticut, on or before April 1. Blank forms of application will be sent on request.

SCIENTIFIC NOTES AND NEWS

DR. ROBERT A. MILLIKAN, of the California Institute of Technology, Pasadena, has been awarded the 1922 Edison medal of the American Institute of Electrical Engineers, for "meritorious experimental achievement in electrical science."

OWING to a severe illness arising from a wound received during the war in France, Sir T. W. Edgeworth David has resigned his position as president of the Australian National Research Council. His place has been filled by the election of Dr. Orme Masson, professor of chemistry in the University of Melbourne. Professor David continues to serve the council as vice-president.

SIR HUMPHREY ROLLESTON has been appointed representative of the Royal College of Physicians on the British General Medical Council in succession to Sir Norman Moore.

THE diploma of doctor *honoris causa* of the University of Strasbourg has been conferred upon Sir James Frazer, author of "The Golden Bough."

IN recognition of his contributions to resuscitation from mine gases, Dr. Yandell Henderson, professor of applied physiology at Yale University, was elected an honorary member of the Coal Mining Institute of America at its meeting in Pittsburgh on December 13.

MR. GEORGE H. RHODES has resigned as assistant in the department of chemistry of the Massachusetts Institute of Technology, Cambridge, Mass., to accept a position in the color laboratory of Cheney Brothers, South Manchester, Conn.

H. A. NOYES has been appointed research chemist for the State Department of Agriculture at Lansing, Michigan, having severed his connection with the Mellon Institute.

PROFESSOR S. WINOGRADSKY, at one time director of the Imperial Institute for Experimental Medicine in Petrograd, has been recently appointed as chief of a newly organized division of soil microbiology at the Pasteur Institute. This division is situated at Brie-Comte-Robert (Seine-et-Marne), France. Professor Winograsky would appreciate literature on soil microbiology.

DR. LOUISE W. FARNAM, a daughter of Professor Henry W. Farnam, of Yale University, reached Changsha on September 21 and has begun her work as head of the department of pediatrics in the Hunan-Yale Hospital and Medical School.

LEAVE of absence has been granted to Dr. A. B. Stout, of the New York Botanical Garden, who will spend the period in southern California in studies of citrus fruits. He will also lecture at Pomona College.

CAPTAIN ROALD AMUNDSEN, head of a polar expedition that left Seattle in June, arrived by dog-team at Nome, Alaska, on December 14. He came from Wainwright, near Point Barrow, where he is wintering.

ROBERT T. AITKEN and John F. G. Stokes, of the Bishop Museum, have returned to Honolulu after an absence of two years devoted to anthropological studies in connection with the Bayard Dominick Expedition Their field of work included the islands of Rapa, Rurutu, Ravaivai and Tubuai of the Austral group. On his return journey to Papeete, several islands of the Tuamotu group were visited by Mr. Stokes.

AT a meeting of the committee on the C. M. Warren Fund of the American Academy of Arts and Sciences held on December 8, a grant

of $250 was made to Professor James B. Conant, of Harvard University, to be used in furthering his research in connection with the electro-chemical study of the reversible reduction of organic compounds. The next meeting of the committee for the awarding of grants will be held on March 1, 1923. Applications for these grants must be in the hands of the chairman of the committee, Professor James F. Norris, Massachusetts Institute of Technology, Cambridge, Mass., before this date.

THE Indian Botanical Society took over ownership and control of the *Journal of Indian Botany* in October. Professor P. F. Fyson, who started the journal in 1919 as a private enterprise, will continue as editor.

PROFESSOR WIELAND has been appointed to the editorial board of *Liebig's Annalen* in place of the late Professor Wislicenus. The board consists, in addition, of Professors Wallach, Graebe, Zincke and Willstätter.

AT the College of Physicians in Philadelphia Dr. James Ewing, of the Cornell Medical School, recently delivered the Muetter Lecture for 1922 on "The principles of the radiation treatment of cancer."

DR. K. F. WENCKEBACH, former professor of surgery at the University of Strasbourg, will deliver the twelfth course of Herter lectures in pathology at the Johns Hopkins University Medical School. Dr. Wenckebach will arrive in this country in April.

THE French committee of organization for the commemoration of the centenary of Pasteur recently held its first meeting under the presidency of M. Strauss, minister of marine. The sum of two million francs has been voted by the French parliament and an exposition has been organized at Strasbourg, where a monument will be erected by public subscription facing the university buildings. Conferences for the popularization of the work of Pasteur will be held throughout France. The celebrations at Paris will take place from May 22 to June 3. The exposition at Strasbourg, which is under the direction of Professor Borrel, will open on June 1.

THE hundredth anniversary of Pasteur's birth will be celebrated on December 27 by Chicago physicians, chemists and bacteriologists at a dinner and meeting under the auspices of the Chicago Medical Society and the Chicago section of the American Chemical Society. Dr. Ludvig Hektoen will preside. The address on Pasteur will be delivered by Professor Victor C. Vaughan, and the response in behalf of France will be made by M. Antonin Barthelemy, consul for France.

SIR ISAAC BAYLEY BALFOUR, for thirty-four years professor of botany at the University of Edinburgh, has died at the age of sixty-nine years.

THE death is announced of Henry John Elwes, past president of the Royal English Arboricultural Society and of the Royal Entomological Society of London.

HARRY J. POWELL, a leader in the scientific development of the manufacture of glass in England, died on November 26 at the age of sixty-nine years.

DR. JOLYET, formerly professor of physiology of the Bordeaux Medical School, has died at the age of eighty-two years.

PROFESSOR ERASMUS MAJEWSKI, the Polish anthropologist, died in Warsaw on November 15.

THE program committee of the Pennsylvania State College Branch of the American Association for the Advancement of Science arranged to have Dr. W. A. Orton, from the Bureau of Plant Industry, Washington, D. C., address the meeting which followed the annual dinner at the University Club on December 12. Dr. Orton discussed the newer knowledge of the properties of plants important in special diet and the necessity of introducing and disseminating additions to our list of vegetables and of providing an all-the-year supply."

Sigma Delta Epsilon, graduate women's scientific fraternity, will hold its national convention in Boston at the time of the meetings of the American Association for the Advancement of Science. There will be an informal luncheon for all scientific women interested in the need

of such an organization on Thursday, December 28. At this luncheon Mrs. Anna Botsford Comstock will speak on "The need of organization among scientific women," and Miss Christianna Smith, national president, on "Sigma Delta Epsilon, graduate women's scientific fraternity."

A CAJAL prize is offered this year by the Academy of Medicine and Surgery at Barcelona, as part of the tribute to Professor Ramón y Cajal. The prize, 1,000 pesetas, will be awarded for the best work describing original research on any histologic topic, accompanied with slides, photomicrographs, etc.

JOHN B. HENDERSON, a regent of the Smithsonian Institution, has purchased for the Division of Mollusks the General Evezard collection of mollusks estimated at from 7,000 to 10,000 specimens, including a large number of types.

AN expedition to study seismic disturbances on the bed of the Pacific Ocean under the auspices of the Carnegie Institution of Washington and the Hydrographic Office of the Navy, will leave San Francisco in the near future. Two American destroyers, the *Hull* and the *Corry*, have been selected for the work. They will carry the sonic depth finder, by means of which it is hoped to make continuous soundings for 7,000 miles along the Pacific coasts of the United States and Mexico. The soundings will be made on parallel lines, approximately at right angles to the 2,000 fathom curve, at intervals of five to ten miles, extending from the coast to a point on the deeper floor of the Pacific Ocean. The expedition, through a more accurate charting of the bed of the Pacific Ocean, aims to throw new light on the causes and the effects of the seismic disturbances that so often occur off the Pacific Coast of North America.

WE learn from the London *Times* that a meeting to consider the question of a memorial to Mr. William Henry Hudson, the writer on natural history, who died last August, was held on November 27 at the offices of his publishers, Messrs. J. M. Dent and Sons, Limited. Mr. R. B. Cunninghame Graham presided and was supported by Lord Grey of Fallodon. It was agreed that the memorial should take the form of a drinking and bathing fountain for birds, to be erected in London, preferably, if the Office of Works approved, at the entrance to one of the bird sanctuaries which are being developed in certain of the public parks, the sanctuary itself to be dedicated to Mr. Hudson. It was further agreed that the portrait of Mr. Hudson painted by Professor A. D. Rutherston should be acquired and presented (subject to its acceptance by the trustees) to the National Portrait Gallery, and such moneys as might be further subscribed to the memorial fund should be devoted to objects similar to those mentioned in Mr. Hudson's will. Mr. Hudson left the residue of his property to the Royal Society for the Protection of Birds, to be used for the purpose of printing leaflets and pamphlets designed to excite in children "that interest in and love of the birds which leads to their protection."

THE council of the Royal Aeronautical Society announces that, through the generosity of the trustees of the Carnegie United Kingdom Trust, they have been able to arrange for the purchase of a large number of valuable historical books on aeronautics. This purchase, together with the works already possessed by the society, renders its collection of early and modern aeronautical literature probably unsurpassed in any country. In recognition of their generosity, the council of the Royal Aeronautical Society has, at the request of the Carnegie trustees, agreed to make the books in the society's library available for any student in the British Isles through the medium of the Central Library for Students, 9 Galen Place, W. C. 1. The library has been formed by the Carnegie trustees to provide a loan collection for students of technical books, which are unsuitable for placing in rural libraries.

IT is stated in *Nature* that the suggestion made by Mr. F. Gill, president of the Institution of Electrical Engineers, in his recent address, that an international European conference should be held with the view of establishing on a commercial basis a practical system of long-distance telephony in the European

trunk lines, has now been realized by M. Paul Laffont, the French minister of telegraphs and telephones. He proposes to invite a conference at Paris of the technical administrators of the western European countries, and he urges that France would naturally be the center of the vast telephone system formed by combining the systems of these countries. The long-distance telephone calls in daily use in America show that, from an engineering point of view, the scheme presents few difficulties. Thus the New York-San Francisco call (3,000 miles) is equivalent to communication between London and Baghdad; the Key West (Florida) and Los Angeles call *via* New York and San Francisco is equivalent to a London-Delhi communication.

THE Department of Commerce announces that provisional figures compiles by the Bureau of the Census for the first six months of 1922 indicate higher death rates than for the corresponding six months of 1921. For the states compared the death rate for the six months was 12.6 in 1922 against 12 for the first six months of 1921. The highest mortality rate for the half year is shown for Maine (15.7) and the lowest for Idaho (8.2). These figures forecast for the year 1922 a somewhat higher rate for the death registration area than the record low rate (11.6) for the year 1921. Provisional birth figures for the first six months of 1922 indicate lower birth rates than for the corresponding six months of 1921. For the states compared the birth rate for the first six months was 22.7 in 1922 against 24.8 in 1921. The highest birth rate for the half year (30) is shown for North Carolina and the lowest (18.1) for Vermont. Births so far reported for the first six months of 1922 indicate a lower birth rate for the year than the 1921 rate for the birth registration area (24.3).

UNIVERSITY AND EDUCATIONAL NOTES

A BEQUEST of $100,000 for the erection of a building for the department of mechanical engineering at the University of Maine, to be named for the donor, is made in the will of Oliver Crosby, head of an engineering firm in St. Paul, Minn.

BAKER UNIVERSITY announces a gift of $100,000 from Mr. Joab Mulvane, a retired banker of Topeka, Kansas, and a member of the board of trustees of the university. The money will be used in the erection of the Mulvane Science Hall.

THE faculty of Case School of Applied Science, Cleveland, Ohio, were notified in October of a new and advanced scale of salaries, which took effect at once. Full professors, of whom there are twelve, will receive $5,000; associate professors, of whom there are eight, will receive $3,300; assistant professors, of whom there are nine, will receive $2,800; and instructors, of whom there are thirty-three, will receive $2,000 to $2,200. The enrollment at Case this year is slightly less than a year ago, numbering 615, with a freshman class of 198.

SIR AUCKLAND GEDDES, British ambassador to the United States, and previously a distinguished professor of anatomy, delivered the address in dedication of the J. William White Surgical Pavilion of the University of Pennsylvania, on December 14. The pavilion is named after the late Dr. J. William White, who was for many years professor of surgery. It was built at a cost of $1,000,000, of which $350,000 was contributed by the state and the remainder by friends of the university.

PROFESSOR GEORGE DAVID BIRKHOFF, of Harvard University, has been appointed lecturer in mathematics at Yale University for the second term. He will give a course in the Graduate School during Professor Ernest W. Brown's absence.

LOUIS AGASSIZ FUERTES, the artist, has been appointed lecturer in ornithology in Cornell University.

DR. H. M. JENNISON, who recently received the degree of Ph.D. from Washington University, has been appointed associate professor of botany at the University of Tennessee, after having completed eleven years' service at the Montana State College.

DR. A. W. GIBB has been appointed to the

newly founded Kilgour chair of geology at Aberdeen.

DR. FRITZ STRAUS, of Berlin, has been appointed professor of chemistry at the Breslau School of Technology.

DISCUSSION AND CORRESPONDENCE

RADIATION A FORM OF MATTER

TO THE EDITOR OF SCIENCE: One sees the statement frequently made that, if one accepts Einstein's conclusion that the mass of a body is proportional to the total energy which it possesses, the principle of the conservation of matter must be abandoned. For if during any change energy is gained or lost by the body through radiation, there should be a corresponding gain or loss of mass. It has been calculated that in the case of radioactive disintegration the energy thus lost (or gained) through radiation represents an appreciable fraction of the total mass of the radioactive material. If, however, one takes the point of view that radiation is a form of matter, and that the amount of this matter is measured by the mass or inertia of the radiation, the total mass of the body plus that of the radiation emitted is unaltered by such changes. On this view the principle of the conservation of mass is strictly valid, being, as has been remarked, a corollary of the energy principle.

It is perhaps surprising to notice that according to the definitions of matter usually given electromagnetic radiation must be classed as matter. It is admittedly difficult to find a satisfactory definition. "Matter is that which occupies space," "matter is that which possesses mass or inertia," "matter is that which affects the senses," are, however, common statements. But radiation certainly occupies space; that it possesses mass is shown by the momentum which it imparts to a body which it strikes, producing radiation pressure; and who would deny that sunlight affects the senses? Unless, therefore, we change our idea of what is meant by the word "matter," this word includes not only solids, liquids and gases, but also the less tangible electromagnetic radiation.

The inclusion of radiation as a form of matter has important bearings in addition to the fact that it renews the validity of the principle of the conservation of matter. Thus, for example, we can no longer say that matter is composed wholly of positive and negative electrons, for the form of matter known as radiation includes no such electric charges. The statement that matter is composed of positive and negative electrons and electromagnetic radiation is, on the other hand, more complex than is required. We see rather that the fundamental thing in matter is not the electric charge but the electromagnetic field, for the electromagnetic field includes both the electrons and the radiation.

If the further simplification is made of considering the magnetic field as due to the electric field in motion, we may describe all forms of matter in terms of the intensity of the electric field at different points. The mass or inertia of the matter is proportional to the integral through the volume considered of the square of the electric intensity and of the magnetic intensity resulting from the motion of the electric field, whether this electric field is due to the presence of electrons or to the existence of electromagnetic radiation. The electric charge in an element of volume is proportional to the divergence of the electric intensity at the point. Thus all the fundamental properties of matter are determined if the intensity of the electric field throughout space and time is known. While the electrons can not be considered the fundamental elements which make up all matter, we have thus the intensity of the electric field as that which can be thought of as composing both the electrons and the radiation. Electric intensity, then, may be considered as that of which all matter is composed.

According to this point of view, matter is perfectly continuous. It is true that there are certain perhaps limited regions, the electrons, from which electric intensity diverges; but whether or not these regions of divergence are limited, the mass of the matter is associated with the electric intensity and is hence distributed through all space. Similarly, radiation propagated through space, as for example light coming from the sun to the earth, is on this view a continuous series of waves of

matter. The old argument for the existence of an ether because some medium is necessary to transfer the radiant energy from the sun to the earth has accordingly no weight. For we now see that the radiation may be its own medium, somewhat as the stream of water from a hose acts as the medium for a wave if the nozzle is shaken.

Perhaps the only new thing in this letter is that, according to the common significance of the word, radiation must be considered a form of matter. But it has seemed to me that a consideration of this fact shows more clearly than we have seen before that matter is essentially continuous, and that the fundamental thing in matter is not the positive and negative electrons but is rather electric intensity.

ARTHUR H. COMPTON
WASHINGTON UNIVERSITY,
ST. LOUIS, MISSOURI

RUSSIAN SCIENTIFIC AID

AT the request of the American Relief Administration, which has been receiving, repacking and forwarding the contributions of American scientific books, journals and papers published since January 1, 1915, for distribution in Russia, I wish to ask that any further shipments from contributors to the New York warehouse (Gertzen and Company, 70 West Street, New York) of the American Relief Administration should be made prior to December 30, 1922. Up to date approximately eleven tons of scientific literature have been sent to Russia by the American committee. This committee wishes to extend its warm thanks to all donors.

In response to the appeal for some money with which to relieve the distress of the hundred Russian intellectual exiles in Berlin, I have received up to this writing $865, of which $500 came as a single gift from Princess Cantacuzene and the rest in five and ten dollar lots from American scientific men. I have no doubt that the total of $1,000 asked for will be reached.

VERNON KELLOGG
NATIONAL RESEARCH COUNCIL,
WASHINGTON, D. C.

SCIENTIFIC BOOKS

THE WATCHERS OF THE SKY[1]

The romance of Science is not an infrequent phrase and it describes as well as any other the dramatic and striking phases of one side of human activity. Its domain is modern because all science is modern as a recognized pursuit and one which is of good repute. It is treated in many forms which vary from the fascinating stories of Jules Verne and H. G. Wells to the lurid and generally inaccurate articles in the Sunday Press. In between, we have many an essay or address which emphasizes the picturesque features of the search for the secrets of nature. But it is new for a poet of the first rank amongst those living to recognize its claims to be classed with love, war, and the more obvious forms of nature's works and human activities for expression in verse. In one respect Mr. Noyes, who follows the great poets of the past in taking a single theme, differs from them. Homer tells of the struggle of man against man, Virgil of man against nature, Milton of man against the unseen powers; it is always warfare or struggle in which one side or the other is to conquer. Here there is no victory and no defeat. The Torch-bearers are striving to learn not by defeating nature but by cooperating with her, and the achievements of nature are of less importance than the methods by which she works. He who learns hands on his knowledge; the torch is passed, not extinguished.

From the preface we learn that the "Watchers of the Sky" is the astronomical portion of a trilogy the title of which "The Torch-bearers" describes the main idea of the treatment. There is no pretence at completeness—the poem is a story not a history—but the torch is followed with some degree of consecutiveness as it passes from the hands of Copernicus through those of Tycho, Kepler, Galileo, until Newton held it high for all the world to see. Later glimpses show William Herschel putting out his hand to take it and Sir John bearing it for a time. The setting of the whole poem places the first and last word on the summit of Mount Wilson

[1] By Alfred Noyes. Published by the Frederick A. Stokes Company.

where Mr. Noyes joined the group of astronomers, mechanics and laborers for the first night on which the hundred inch reflector was ready for use and took his place with them for a glance through it at Jupiter and its moons.

This bare outline is but the frame-work which Mr. Noyes built to contain the ideas he tries to set forth. He recognizes fully that the great common ground between science and poetry is the exercise of the creative imagination and in all his description pays less attention to the actual discoveries than to the ideas which led to them. Copernicus and Galileo in their interpretations of the motions of the planets and stars, Tycho in his observations for the use of future astronomers, Kepler in framing simple laws, and Newton in placing the key-stone in the arch, are to Mr. Noyes guides who lighted up the routes rather than discoverers and builders. Let lesser men string the lights which illuminate the territories of knowledge; the torch-bearers are those who show the way to them. In fact, Mr. Noyes has succeeded to a considerable extent in absorbing and emitting thoroughly modern views of what constitutes the highest achievement in scientific work.

One is tempted to much quotation to illustrate how Mr. Noyes has worked out his theme and I shall indulge in it to some extent. Some of his attempts strike the reader as achieving a high plane of expression. He has, it is true, almost wholly used the medium of blank verse, which gives him considerable freedom, but the rhythm rarely fails even when he has set himself the difficult task of setting forth some of the more technical laws of nature. While he exercises the poet's right to give such parts of the truth as will illustrate the whole, in doing so he avoids with some success the danger of making wrong statements. Kepler's three laws are given in detail: his wording of the third is rather happy:

> Third, that although their speed from point to point
> Appeared to change, their radii always moved
> Through equal fields of space in equal times.

In describing Newton's experiments, he tells how

> He caught
> The sunbeam striking through that bullet-hole
> In his closed shutter—a round white spot of light
> Upon a small dark screen. He interposed
> A prism of glass. He saw the sunbeam break
> And spread upon the screen its rainbow band
> Of disentangled colours, all in scale
> Like notes in music; first, the violet ray,

And then, after describing how each ray was bent differently by a second prism,

> Last, he took a lens,
> And, passing through it all those coloured rays,
> Drew them together again, remerging all
> On that dark screen, in one white spot of light.

The last steep is not quite clear but it gives the idea.

Mr. Noyes exhibits considerable skill in choosing the method by which he shall describe each of his characters and make them tell of their work and ideas. For the first of them,

> The neighbours gossiped idly at the door.
> Copernicus lay dying overhead.
> * * * * * *
> His book has come
> From Nuremberg at last; but who would dare
> To let him see it now? They have altered it!
> Though Rome approved in full, this preface, look,
> Declares that his discoveries are a dream!
> He has asked a thousand times if it has come;

While waiting and hoping for it to come he muses on his life and work:

> So, all my life I pondered on that scheme
> Which makes this earth the centre of all worlds,
> Lighted and wheeled around by sun and moon
> And that great crystal sphere wherein men thought
> Myriads of lesser stars were fixed like lamps,
> Each in its place,—one mighty glittering wheel
> Revolving round this dark abode of man.

He was puzzled how to account for the motions of the planets and felt that he must tell the world his ideas before he goes out. Blindness comes on and they put the book in his hands:

> It is here!
> Put out the lamp, now. Draw those curtains back,
> And let me die with starlight on my face.

The story of Tycho is told in full from

> The boy at Copenhagen, with his mane
> Of thick red hair, thrusting his freckled face
> Out of his upper window, holding the piece
> Of glass he blackened above his candle-flame

who later

While his tutor slept,
Measured the delicate angles of the stars,
Out of his window, with his compasses,
His only instrument.

Looking down he sees Christine, "the blue eyed peasant girl," who afterwards accompanies him to Wheen in the Sound where with the King's help he

built himself that wonder of the world,
Uraniborg, a fortress for the truth,
A city of the heavens.

He tells her all his hopes:

There's one way,
And only one, to knowledge of the law
Whereby the stars are steered, and so to read
The future, even perhaps the destinies
Of men and nations,—only one sure way,
And that's to watch them, watch them, and record
The truth we know, and not the lies we dream.

Mr. Noyes follows him through the many years of work on the island to the time when, under a succeeding ruler, support was withdrawn. He was exiled and as a result meets with Kepler who describes his last moments. The story of Tycho is perhaps the most successful effort in the volume.

Kepler is shown in his home expecting a visitor, Sir Henry Wotton, and discoursing to his wife about poets and their natures. She lets him run on and after his longest disquisition:

'John, I'm afraid!'
'Afraid of what, Susannah?'
'Afraid to put those Ducklings on to roast.'

But the ambassador arrives early and Kepler has to fill in the time talking with him in his study. It is here he has the opportunity to tell of his work and to state the laws of planetary motion. Throughout, however, he gives the credit to Tycho:

I owed so much
To Tycho Brahe; for it was he who built
The towers from which I hailed those three great laws.

The story of Galileo is chiefly written round the famous trial which Mr. Noyes has apparently investigated with some care. There is here much less astronomy and physics and more philosophy. The story of the reception of his telescope is interestingly told, however, and the author finds an opportunity to give a politician's view of a scientific discovery:

Whereat old senators, wagging their white beards,
And plucking at golden chains with stiff old claws
Too feeble for the sword-hilt, squeaked at once:
'This glass will give us great advantages
'In time of war.'

Mr. Noyes follows Isaac Newton through the productive period of his life and gives in some detail the chief of his discoveries. We have already quoted from the description of his experiments on light. There follow a few lines about

That first reflecting telescope which should hold
In its deep mirror, as in a breathless pool
The undistorted image of a star.

A long and faithful description of the work on gravitation follows, including the incident where Newton obtained the new value of the Earth's diameter and was too excited to finish the calculations which showed that his theory was right. Mr. Noyes gets some fun with talk of Pepys about Newton and his table,

Littered with papers, cups, and greasy plates
Of untouched food. I am told that he would eat
His Monday's breakfast, sir, on Tuesday morning,
Such was his absent way!

In the penultimate scene, Newton, now an old man, muses over his early days and his work in a letter to an old sweetheart. The last phase is put into the mouth of Dean Swift.

The "Watchers of the Sky" is probably not a literary landmark of the first order, but it is a very important and attractive addition to the growing list of volumes which are bringing scientific ideas and their history to the attention of the general public. Whatever may be said concerning its merits,—and there are decided differences of opinion possible on that score—it has certainly the excellent quality of being interesting throughout. Many will read it through for that reason alone. It is essentially a volume which should be in everyone's library especially where there are boys and girls growing up. Parents are advised to "leave it about" but not to recommend their children to read it if they wish them to enjoy it.

ERNEST W. BROWN

SPECIAL ARTICLES

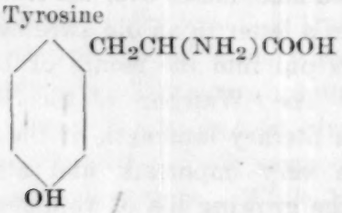
IODINE AND ANURAN METAMORPHOSIS

THE following experiment shows clearly the importance of iodine in inducing anuran metamorphosis and indicates that other halogens such as bromine can not be substituted for it.

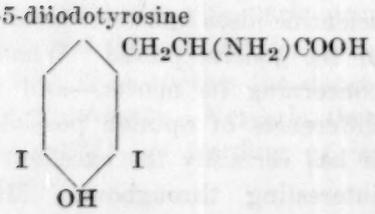
Thyroidectomized and hypophysectomized *R. sylvatica*, the glands of which had been extirpated early in embryonic life, were kept until after the normal time for metamorphosis had elapsed and the normal controls had transformed, and then divided into three sets for experimental purposes. It will be recalled that thyroidless and pituitaryless larvæ do not metamorphose but remain permanent tadpoles unless fed thyroid derivatives or very large amounts of iodine. One set of animals was fed quantities of pure tyrosine $CH_2CH(NH_2)COOH$ each day and allowed to remain in weak solutions of this substance six to eight hours every day. The remainder of the time they were kept in large glass containers and fed large quantities of spirogyra.

The second lot of animals was fed equal quantities of tyrosine in which two atoms of iodine had been substituted for two hydrogen atoms of the tyrosine—forming the well-known compound, 3-5-di-iodo-tyrosine. The iodine in this compound is, of course, an integral part of the molecule.

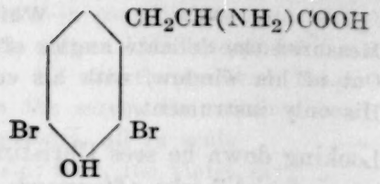
Tyrosine



3-5-diiodotyrosine



The third set of tadpoles was fed quantities of tyrosine equal in amount to that received by the other two cultures, in which two atoms of bromine had been substituted for two hydrogen atoms of the tyrosine molecule forming the compound 3-5-di-brom-tyrosine.



The di-brom-tyrosine was prepared according to the method of C. T. Mörner, 1913, *Zeitschrift für physiologische Chemie*, Vol. 88.

The animals fed tyrosine and spirogyra showed no changes indicative of metamorphosis after sixty days of continuous feeding, though the normal growth rate was not interrupted. After the twenty-fifth day the hind legs differentiated and grew very slowly until they attained a length of 3 to 5 millimeters. There were no signs of fore legs, skin autolysis in the pectoral region, tail shrinkage or anything suggesting transformation.

The animals fed 3-5-di-brom-tyrosine behaved in identical fashion with those of the tyrosine-fed culture and no metamorphosis resulted. At the end of the second month of feeding the hind legs of the animals of the culture averaged five millimeters. The growth rate of the animals was not interfered with by the brom-tyrosine compound. Insofar as the acceleration of metamorphosis is concerned, the results obtained by feeding tyrosine and 3-5-di-brom-tyrosine are essentially negative.

Conversely the administration of 3-5-di-iodo-tyrosine to thyroidless and pituitaryless larvæ brought about very striking results, and in so far as metamorphosis is concerned, simulated the action of thyroid extract, although the effect of the latter is somewhat more rapid. Within a few days after feeding iodo-tyrosine the animals appear thin and emaciated; the limbs grow rapidly and the other changes incident to metamorphosis appear. Twenty days after the date of first feeding the entire culture of thyroidless animals had completed metamorphosis except for the loss of the tail. The pituitaryless animals developed fore and hind legs, frog mouths but invariably died before tail resorbtion was complete. In two pituitaryless animals the right fore legs broke through the skin eight days after the animals were placed upon the iodo-tyrosine diet. These two

individuals were exceptional in this respect, the average time being about twenty days.

These results are of significance for several reasons: 1. The experiment is clear cut and admits of but one interpretation, *i. e.*, that it is the iodine within the tyrosine molecule that is essential for Anuran metamorphosis, because tyrosine without the two atoms of iodine is incapable of inducing metamorphosis.[1]

2. Thyroidless and pituitaryless frog larvæ do not metamorphose unless fed thyroid substance or very large quantities of elemental iodine. Such larvæ have no thyroid mechanism for the manufacture of the thyroid hormone, yet apparently are able to utilize inorganic iodine when administered in very large quantities along with normal food. The substitution of the two iodine atoms for two hydrogens of the tyrosine molecule transforms the tyrosine into a highly active metamorphosis-inducing agent far superior to any quantity of elemental iodine in its rate of action and second only to the thyroid hormone itself. It seems clear that in tadpoles metamorphosis depends upon an organic iodine complex of some sort, and that the iodine to be effective does not need to undergo transformation within the thyroid gland. It is evident that when thyroidless larvæ metamorphose when fed quantities of inorganic iodine, the latter to be active must enter into organic combination with either the body proteins of the larvæ or the algæ fed with it.

3. Iodized proteins and amino-acids have been employed by several investigators in the treatment of various disorders of the thyroid in cases of human hypothyroidism, but the writer has never heard that such products can completely take the place of the thyroid hormone. Yet in thyroidless Anuran tadpoles iodo-tyrosine to all intents and purposes is as good as the thyroid secretion in transforming the individual, *i. e.*, it completely takes the place of the gland secretion in so far as metamorphosis is concerned.

Metamorphosis in Anurans is dependent upon a peculiar property of the iodine atom when organically combined in a certain way and it seems that mammals and Anurans are not to be compared in regard to their reactions to iodine. Thyroidless tadpoles promptly metamorphose when fed iodized amino-acids or large quantities of elemental iodine, but thyroidless mammals and individuals with atrophied and very degenerate glands can not utilize elemental iodine at all, and the same is probably true of iodized amino acids. Voegthlin and Strouse ('09, *Journal Pharm. and Exp. Therap.*) observed that iodized amino-acid fails to replace the thyroid function in pathological cases of hypothyroidism, *i. e.*, myxedematous and cretinous mammals, nor was the nitrogen metabolism or blood pressure of dogs influenced by administration of this substance. Furthermore, Miura ('22, *Jour. Lab. and Clinical Med.*, Vol. 7) has made the interesting observation that di-iodotyrosine gives no protection to mice against lethal doses of acetonitrile, whereas thyroid tissue protects these animals against the poison.

It is clear that in so far as the metamorphosis of thyroidless and pituitaryless tadpoles is concerned iodo-tyrosine is practically as good as the thyroid hormone but this same substance in mammals can not be substituted for the glandular tissue itself.

4. The suggestion of some recent writers that bromine if it could be substituted for the iodine of the thyroid might prove just as active physiologically, is not borne out by these experiments. Bromine has no influence upon Anuran transformation and can not be substituted for iodine.

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OCTOBER 5, 1922

[1] Large axolotls seven inches long were *thyroidectomized* and kept five months following the operation and then twice injected with iodotyrosine. Metamorphosis resulted within seventeen days following the first injection. Similar animals injected with tyrosine and dibromtyrosine did not transform. Partially thyroidectomized axolotls (two thirds of the gland excised) were kept five months and then twice injected with iodo-serum globulin. Metamorphosis occurred within sixteen days. Uhlenhuth's claim that Urodele larvæ differ from Anurans in regard to metamorphosis and iodine is not sustained.

THE AMERICAN CHEMICAL SOCIETY

DIVISION OF PHYSICAL AND ORGANIC CHEMISTRY

(Continued from November 17)

The conductivities, viscosities and densities of solutions of mixed electrolytes. (Lantern): C. E. RUBY and J. KAWAI.

The mutual solubility of liquids: Two new methods for determining the same: ARTHUR E. HILL. The published results on the solubility of liquids are meagre compared with the voluminous data on the solubility of solids. It is proposed to study a number of new cases, and repeat some determinations which appear to be inaccurate. No methods have proved to be of universal applicability. In place of the terms synthetic and analytic methods, which do not indicate the essential differences in procedure, the term thermostatic is proposed for methods in which the temperature is held constant and plethostatic for methods in which the concentration is fixed and the temperature changed to the point of beginning heterogeneity or homogeneity. As a new thermostatic method suitable to liquids of moderate solubility, the measurement of the volumes obtained in suitable volumetric apparatus in two experiments may be used, on the basis of the phase rule, to calculate the solubilities. An accurate determination of the solubility curves for ether and water has been made by this method. For liquids dissolving very small amounts of water the use of silver perchlorate is proposed; the solubility of this salt rises sharply with the presence of small amounts of water, so that, after establishment of a reference curve at a standard temperature (25°), the solubility of water at any other temperature can be determined. The solubility of water in benzene and in aniline has been measured by this second method.

The occurrence of closed solubility curves in three-component systems: ARTHUR E. HILL. Closed solubility curves have been found in several two-component systems, such as nicotine and water. Among three-component systems the closed curve has been found only once, in the case of silver perchlorate, water-benzene, recently published by the author. The same type of curve has now been found in the system silver perchlorate-water-toluene, and exists from room temperature to some temperature above 100°. In both these cases, the curve for the two component systems (silver perchlorate-benzene and silver perchlorate-toluene) approaches a perpendicular to the temperature axis, *i. e.*, the two components just fail of breaking into two liquids; the addition of the third component evidently decreases the mutual solubility, causing the formation of two liquid phases. It is well known that, when there is limited solubility of two liquids, a third component may either increase or decrease that solubility. Where there is unlimited solubility of two components in the fused state (*i. e.*, only one liquid phase exists), the addition of the third component should again act either to increase or decrease miscibility; but if the two-component system shows a nearly perpendicular curve, indicating that the forces existing are only just sufficient to hold the two components in solution, a third component chosen to reduce mutual solubility should result in a separation into two liquid phases, which, in the three-component diagram, leads to a closed curve. We may therefore look for closed curves in three-component systems most hopefully where one of the two-component systems shows a solubility curve of the type described.

Solubilities up to the critical temperature: P. A. BOND and M. C. WADDELL. I—Methods of manipulation. II—Solubilities in sulfur dioxide at 25° C. A method for determining solubilities up to the critical temperature has been developed. The apparatus and method of manipulation are discussed. Solubilities in sulfur dioxide at 25° C. have been determined for salts of potassium, silver, cadmium, tin, antimony, tellurium, manganese and in one case for Ba as the thiocyanate. Aside from the solubilities as determined, interesting reactions between sulfur dioxide and chlorates, bromates, iodates and nitrates were noticed. Also a double layer was formed in the case of SnBr. Work is to be continued until salts of all metals have been tried, and in cases where solubility is shown is to be carried on at different temperature levels.

Vapor pressures of certain hydrated sulfates: CLIFFORD D. CARPENTER and ERIC R. JETTE. The vapor pressures of some of the hydrated sulfates of Cu, Mn, Mg, Co, and Cd have been studied at a number of temperatures below the transition points, and the saturated solutions of some of them at several temperatures above these points. Some of the determinations have been carried as high as 90° C. A modification of the Bremer-Frowe tensimeter was used. All points were determined by approaching equilibrium from both a higher and a lower pressure. A special thermostat was constructed for the higher temperatures. The results obtained have been used in plotting the vapor pressure curves, in calculating the heats of vaporization, and for plotting

the $\log p - \frac{1}{T}$ relation. The $\log p - \frac{1}{T}$ relation gave straight lines in every case, and these lines intersected sharply at the transition points. Some transition points are definitely located by the intersection of the vapor pressure curves. There are certain limitations in using vapor pressure data for interpreting the nature of the phenomenon.

Electroadsorption as a pure chemical phenomenon: J. W. ELDER, E. B. STARKEY and N. E. GORDON. An investigation to throw more light on the relation between electroadsorption and pure chemical action. The work was carried out with the hydrogels of ferric oxide and silica acting as the adsorbents. Such salts were used so as to have the resulting products of different solubility provided there was a chemical reaction. The electroendosmosis of each system was investigated in order to correlate, if possible, any electrochemical behavior.

Adsorption by activated sugar charcoal. II: F. E. BARTELL and E. J. MILLER. This paper presents the results obtained in a study of the nature of adsorption of electrolytes from solution by activated ash-free sugar charcoal. It includes data on the adsorption of acid dyes, basic dyes, organic and inorganic acids and inorganic bases. A brief discussion of the theory of hydrolytic adsorption of electrolytes is given, followed by a consideration of results obtained with a number of salt solutions with activated sugar charcoal. The variation of these results from those obtained by other investigators who have used charcoals of animal or vegetable origin is pointed out.

The influence of temperature pressure and catalyst support material upon adsorption by catalytic nickel: A. W. GAUGER and HUGH S. TAYLOR. (1) Adsorption isotherms of hydrogen on nickel have been determined, using nitrogen as a reference gas. A definite saturation capacity of nickel for hydrogen exists, dependent upon the temperature; (2) From the variation of the saturation pressure with temperature the heat of adsorption of hydrogen on nickel has been calculated to be approximately 2,500 calories; (3) The effect of using an inert material for catalyst support has been found to increase greatly the adsorptive capacity per gram of nickel and to yield a catalyst that will stand much more severe heat treatment without diminution of its adsorbing power.

An instrument for measuring the rate of swelling of gelatine films on rigid supports: S. E. SHEPPARD and FELIX A. ELLIOTT. An instrument was described which consists essentially of a balance beam resting upon a fulcrum which can be raised and lowered by means of a micrometer screw. At one end of the balance beam hangs a slender but rigid quartz rod, the end of which is flattened to form a foot ca. 2 mm. in diameter. The weight of this rod is carefully counterbalanced within a few mgs., allowing just enough "out of balance" to insure constant but practically weightless contact between the foot and the swelling gelatin surface. The gelatin coated plate is securely clamped in a jacketed tray just below the quartz rod. An optical system indicates the condition of balance, the fulcrum is lowered until balance is indicated, a reading made, and solution acting on the gelatin poured in the tray and the fulcrum raised as may be necessary to maintain balance. Readings are made periodically. The sensitivity is about 0.001 mm. and the precision 5 to 1 per cent., depending upon the rigidity of the jelly. Measurements have been made using glass plates coated with gelatin and also emulsion coated plates. These were swollen in acids and alkalis as well as salt solutions and photographic developing baths. Although differing in degree all curves indicated a rapid initial swelling asymptotically approaching an equilibrium.

The effect of gravity and light on the formation of Liesegang bands in gelatin and silicic acid. (Illustrated): EARL C. H. DAVIS. Gravity has but little effect on the formation of periodic bands in gelatin as shown experimentally. Light is one of the most important variables in making rhythmic bands of gold in silicic acid. At the concentrations used no bands were formed in the dark at either 0° C. or at room temperatures. Periodic variations of strong light and darkness produce bands in those regions in which there is still adsorbed molecular gold, excess oxalic acid and suitable amounts of the products of the reaction. These by-products make precipitation in bands possible because they influence the tendency toward imbibition and peptization so that the gold is precipitated in "pockets" just large enough to give a colloidal dispersion. There is no fundamental difference between the bands of blue gold and those of red. The location of the colloidal bands can be governed by a black paper which surrounds the tube and has slits cut in it at regular intervals. With a Mazda light placed near such a tube in the dark room for a week the bands at the openings are coarse particles

instead of being colloidal. That is, they are yellow crystals. Contrary to some previous observations rhythmic bands of the silver chromate form in darkness at 0° C. and room temperatures.

Ferric oxide hydrosol. II. The chlorine and hydrogen ion activities and the heat of coagulation with sodium sulfate: FREDERICK L. BROWNE. A study has been made of the hydrogen and the chlorine ion activities in ferric oxide hydrosol and in hydrolyzed and unhydrolyzed ferric chloride solutions. From these data the distribution of $FeCl_3$ and HCl between the dispersed phase and the dispersion medium has been computed. When the heat of coagulation of these sols with Na_2SO_4 is corrected for the heat of mixing of Na_2SO_4 with the $FeCl_3$ and HCl present, there is left a small positive heat effect which is proportional to the amount of Na_2SO_4 adsorbed during coagulation and amounts to about 1,200 cal. per g. eq. Na_2SO_4 adsorbed.

Ferric oxide hydrosol: ARTHUR W. THOMAS and ALEXANDER FRIEDEN.

A note on quinaldine pink: HANS T. CLARK and FELIX A. ELLIOTT.

The coagulation and repeptization of colloidal ferric hydroxide by alkalis: ROBERT E. WILSON and PHILIP S. CLARK. In order to improve the efficiency of removal by filtration of small amounts of colloidal ferric hydroxide from hot water which has been passed over sheet iron to remove dissolved oxygen, a study was made of various possible coagulating agents for ferric hydroxide. It was found that alkalis were by far the most effective precipitating agents in small amounts, and that as low as .05 per cent. NaOH effected practically complete coagulation in a very short time. *Larger* amounts of alkali were found to *decrease* the efficiency of filtration, and this behavior was eventually shown to be due to the repeptization of the ferric hydroxide as a *negative* colloid, with markedly different properties.

Gum dammar as an emulsifying agent: HARRY N. HOLMES and DONALD CAMERON. Since gum dammar is insoluble in water but soluble in many other liquids its use as an emulsifying agent forces water to become the internal or dispersed phase in the "water-in-oil" type of emulsion. Such emulsions are more stable and may be made much richer in water than by the use of calcium soaps. Salve-like emulsions are readily made by mixing a solution of the gum in benzene with a relatively large amount of vaseline or heavy oil and then rubbing in the desired amount of water. Printers' or lithograph inks may be greatly cheapened by the incorporation of water, dispersed in minute drops, by the use of this gum as emulsifying agent. Since much of the drying oil is used merely to give a proper working body, the use of water, well emulsified, will give the requisite body more cheaply while a smaller amount of the drying oil is adequate for adhesive purposes. Paints, varnishes and greases may be diluted in similar fashion.

Cupric oxide jellies and the general theory of jelly formation: HARRY B. WEISER. A dilute colloidal solution of hydrous cupric oxide is formed by adding ammonia short of precipitation to a saturated solution of cupric acetate. This colloid coagulates on standing, forming a gelatinous precipitate of the hydrous oxide. By adding a suitable small amount of sulfate to the acetate solution before adding ammonia, a more concentrated colloidal solution of hydrous cupric oxide may be prepared. This colloid is likewise instable and, under suitable conditions, coagulates with the formation of a stable jelly. The sharply defined conditions of formation and the effect of electrolytes on the stability and rate or precipitation of the colloidal oxide support the author's general theory of the formation of inorganic jellies proposed at the Birmingham meeting.

A rapid method for the preparation of some dilute silica gels: L. H. REYERSON and WM. T. MORIN. It has been found that ammonium hydroxide solutions will under certain conditions cause solutions of sodium silicate, mixed with hydrochloric or sulfuric acids, to set to gels. Using this method it has been possible to set gels with an SiO_2 concentration as low as approximately one half of one per cent. Gels as low as two per cent. will set almost instantly. The characteristics of these dilute gels are being studied.

Studies on the nature of the reducing action of charcoals on certain salt solutions. I. Silver nitrate: L. H. REYERSON and MAX LATSHAW. The reducing action of various charcoals upon silver nitrate solutions has been studied. An almost ashless charcoal was prepared in order to eliminate the interferences due to impurities. Neutralization of surface charges does not account for the reduction to metallic silver. Evidence from Hulett's work as well as our own investigations points to the fact that an active form of hydrogen, strongly adsorbed by the charcoal, is the reducing agent. Silica gel outgassed at 400 C. and cooled in an atmosphere of hydrogen reduces silver ion in silver nitrate solutions to silver. This reaction is being studied in its effect on various cations,

especially those which lie below hydrogen in the electromotive force series.

Behavior of aqueous potassium permanganate in the presence of potassium hydroxide: WILLIAM LERCH and J. E. DAY. The rate of decomposition of an aqueous solution of potassium permanganate (free from reducing substance) in the presence of varied amounts of potassium hydroxide (free from reducing substances) was observed at the temperatures 75 and 105° Centigrade (approximately) For a concentration of KOH at and below 0.7 M no change in oxidizing potential occurred at 73° in 182 hours. Increasing temperature and alkalinity resulted in an increase in the per cent. of $KMnO_4$ converted to K_2MnO_4. At 105° Centigrade and a causticity of 11.7 M the percentage change was 90.3. The rate of change curves are log curves.

Some properties of arsenic trioxide in aqueous solution: ERNEST ANDERSON and R. G. STORY. The density and refractive index curves of As_2O_3 in aqueous solution were found to be straight lines. The equation for such a curve is: $W = A + BX$. The constants A and B for both curves were accurately determined at 25° C. The weight of As_2O_3 calculated from either density or refractive index by the constants A and B agree exactly with analytical determinations. The solubility curve, degree of hydration and hydrogen ion concentration were also determined for As_2O_3 in aqueous solutions.

Preparation of antimony-free arsenious trioxide: C. W. FOULK, P. G. HORTON and G. M. MCCLURE. Arsenious trichloride is first prepared either by heating the oxide with concentrated hydrochloric acid and distilling or by adding sulfuric acid to the hydrochloric acid solution and drawing off the layer of trichloride. The separation from antimony can be effected by several distillations of the arsenious trichloride or better and easier by shaking the trichloride two or three times in a separatory funnel with a little less than its own volume of concentrated hydrochloric acid. The antimony goes into the water-acid phase.

The determination of lead in lead amalgam: M. G. MELLON. Lead in lead amalgam may be displaced by copper from an aqueous solution of copper nitrate with the formation of copper amalgam and lead nitrate. The lead may then be precipitated and weighed as the chromate. Data are given to show the accuracy of the method and the effect of time, temperature and concentration of copper nitrate upon the displacement reaction. The mercury is not dissolved in the determination, and it may be purified for further use.

The volumetric determination of phosphorus: WILLIAM A. TURNER. Experiments undertaken using the Pemberton or Kilgore volumetric method for phosphorus show a positive error of approximately 8 per cent. when compared with results obtained by the gravimetric method. It is shown that the factor for the phosphorus equivalent of the alkali solution as given in the official methods of the A. O. A. C. and in many textbooks is derived from an incorrect reaction. The precipitate of ammonium phosphomolybdate as ordinarily produced contains acid not removed by washing with a neutral salt solution. The precipitate, therefore, is not $(NH_4)_3PO_4 . 12MoO_3$, as commonly assumed, but $(NH_4)_3PO_4 . 12MoO_3 + 2$ mols. HNO_3 or an equivalent amount of some other acid. Such a precipitate requires a larger proportion of alkali. The correct reaction is, $2[(NH_4)_3PO_4 . 12MoO_3 . 2HNO_3] + 50NaOH = 2(NH_4)_2HPO_4 + (NH_4)_2MoO_4 + 23Na_2MoO_4 + 4NaNo_3 + 26H_2O$. A factor calculated on this basis calls for an 8 per cent. reduction in the phosphorus equivalent of the alkali solution. Such a factor gives results which agree very closely with the gravimetric method.

Note on apparatus for preparation of conductivity waters: C. W. FOULK and A. P. BAWDEN. The device is an accessory for conductivity water stills because its use eliminates corks or rubber stoppers for connecting glass flasks with condensers. Briefly, it consists of a circular tin block on one end of which an annular depression is turned to engage the mouth of the flask to be used. Gaskets of tin-foil can be employed if necessary. The block is held in place by means of springs stretched between it and a brass collar around the neck of the flask. The inner tube of the condenser passes through a hole in this block, the connection being made by soldering with tin.

Determination of the specific gravities of minimal amounts of materials by the immiscible balance: WILLIAM G. EXTON. It is often necessary (blood and other body fluids, scums, dust, etc.) or expedient (viscosity, expense of materials, etc.) to determine the specific gravity of minimal amounts of liquids or solids, and this may be done rapidly and conveniently with the immiscible balance. The material to be tested is suspended in equilibrium in a mixture of two solutions (light and heavy) which are miscible with each other but not with the sample, *i. e.*, petroleum

ether-carbon tetrachloride, benzol-chloroform, alcohol-water, brine-water and other combinations are suitable. The apparatus consists of a cylindrical mixing chamber having for its floor a stopcock of special design which connects with a thistle tube and a spout. With the cylinder partly filled, a drop or a fragment of the material to be tested is immersed, and the specific gravity of the mixture is then varied at will without agitation of any kind by dropping the heavier component in from above or forcing the lighter component into the cylinder from below until the mixture has the same specific gravity as the material to be tested. The specific gravity of the mixture is then determined by Westphal balance or by a hydrometer of special design. The design of the stopcock permits the separated discharge of mixing chamber and thistle tube into their respective containers so that the solutions may be used repeatedly or determinations made in series without discharging the contents by removing the material. The method is delicate, has a wide margin of safety from error and the attainable accuracy seems limited to the accuracy of the method used to obtain the specific gravity of the mixture.

A new method for the control of thermostats: D. J. and J. J. BEAVER. A method for accurately controlling the temperature of a thermostat for long periods is described in which a very small current, of the order of 10^{-5} amperes, is amplified by a vacuum tube sufficiently to actuate a magnetic relay. The circuit is so designed that the chattering of the relay can be prevented by electrical methods. The effect of an oscillating point is obtained without an elaborate mechanism and the back-lash at the mercury contact surface is prevented by the use of iron wire for the contact point. A sensitive thermoregulator is described which is made of monel metal tubing filled with mercury. A simple method of connecting glass to metal is described.

Adiabatic calorimetry at high temperatures: J. W. WILLIAMS and FARRINGTON DANIELS. Adiabatic calorimetry is possible at high temperatures if sufficient precautions are taken to prevent thermal leakage from the inner calorimeter to the room. The construction of such a calorimeter is described. The outer bath, a glycerine solution of ferric chlorids, is heated electrolytically. Thermal leakage along the resistance thermometer is difficult to overcome, so it is placed in the outer bath, and readings are taken when its temperature is identical with that of the inner calorimeter as shown by zero reading on a sensitive thermocouple. The specific heats of aniline and nitrobenzene in the neighborhood of 100° have been determined.

Black phosphorus: CLAUDE HAINES HALL, JR. The author has collected and analyzed the somewhat extensive and complicated literature relating to black phosphorus. He has shown that in reality two distinct substances have been given this name. The first, discovered by Thenard in 1812, is not a true allotropic modification but is a colloidal suspension while the second, discovered by Bridgman in 1914, is a true modification. He has devised an apparatus to extend Svedberg's method of preparing colloidal suspensions to phosphorus and has definitely prepared suspensions of copper phosphide and mercury in phosphorus. The properties of these suspensions are described.

Notes on potassium chlorate: H. W. MOSELEY. In this paper the following matters are presented: first, the preparation of specimens of potassium chlorate by altogether different and independent methods; second, the details of the determination of the melting point of the several specimens with check results (the literature shows a variation of 40° in this constant), the composition of the bath necessary for this measurement, and the fact of no decomposition at the melting point; third, the determination of the temperature of beginning decomposition with a study of the decomposition reaction up to and including 500° C.

Ozone: electrical preparation and analysis: A. SILVERMAN and PAUL C. SAUNDERS. Ozonizing unit employed for the generation of ozone is a modificatiion of the Berthelot apparatus. The oxygen generator, purifying train, ozonizer, manometer and analyzer are all parts of a single piece of apparatus. All connections are of glass. The parts of the unit are so constructed that all readings can be made in a thermostat. Within the limits of operation employed only O_3 was obtained. Yields have been calculated on the basis of energy consumption. Concordant results have been obtained under given sets of conditions. Drawings accompany the article and lantern slides will be employed in its presentation.

The analysis of gaseous mixtures of nitrogen peroxide, nitric oxide, nitrous oxide and nitrogen: LOWELL H. MILLIGAN and C. HERBERT QUICK. The gases are conveyed by pure CO_2 through an absorption train which removes NO_2 and NO, and then through NaOH soln, which takes out the CO_2 and over the surface of which the N_2O and N_2 collect. The N_2O is determined by slow-com-

bustion with hydrogen and the N_2 is obtained by difference. In the absorption train conc. H_2SO_4 is used to absorb NO_2, and part of the NO if the latter is present with NO_2. The total nitrogen and the nitrous nitrogen in the acid are afterward determined, and from them the NO_2 and NO absorbed are calculated. A definite volume of std. permanganate soln., acidified with H_3PO_4, is used to absorb the rest of the NO, and afterward the excess permanganate is determined. The total NO originally present is the sum of that absorbed in the H_2SO_4 and in the permanganate soln. The method was tried on known quantities of the gases, and was found satisfactory.

The action of hydrogen peroxide on photographic gelatino-silver halide emulsions: S. E. SHEPPARD and E. P. WIGHTMAN. A detailed study of the action of hydrogen peroxide on photographic plates has been made with the idea of obtaining more complete data on the subject in order to compare the action with that of light in the formation of latent images. Both the intensity (concentration) and time factors were considered as well as development conditions. As a side problem it was found necessary to consider also the effect of concentration of the acid (or alkali) content of the hydrogen peroxide. The effects are in many ways quite similar to the action of light. Other conclusions can not be drawn until further work has been completed. We have proposed the tentative hypothesis that silver nuclei in the silver-halide grains serve as catalytic agents for the decomposition of hydrogen peroxide which is chemi-luminescent.

Reactions at boundaries of phases; the problem of promoter action and the theory of the latent photographic image: HUGH S. TAYLOR. From a literature study and from investigations it has been established that the boundaries of two phases constitute a most reactive portion of a heterogeneous system. Evidence is available to show that a number of cases of promoter action can be attributed to enhanced reactivity of mixed catalysts at interfaces between the components of the catalyst mixture. The analogy between the development of the latent photographic image and the reduction of metallic oxides by various reducing gases at low temperatures can be established. Studies of the latter are very suggestive as to the necessary extent of nuclei production precedent to the production of a developed image in the individual grain of the photographic emulsion.

Hydrogen ion catalysis in lactone formation: H. W. CLOSE and HUGH S. TAYLOR. A study of the catalytic conversion of hydroxy-acids to lactones, using acids as catalysts, has been made. The influence of variation of the catalyzing of acid and of its concentration, of added neutral salts and of their concentration, of temperature and of the solvent, have been made the object of investigation. It has been shown that it is probably the non-hydrated hydrogen ion which is the active catalytic agent. The remarkable results which this leads to, when ether is used as solvent, have been outlined and experimentally verified.

The hydrogen ion concentration of buffer solutions at elevated temperatures: ROBERT E. WILSON. Despite its importance from a number of aspects, there is practically no data in the literature as to the hydrogen ion content of the various recognized "buffer" solutions at temperatures above 40° Centigrade. Since the p_H of neutral water and of ordinary solutions of alkalies drops off markedly with increasing temperature, on account of the increased ionization constant of water, it was especially desired to determine how the alkaline buffer solutions behaved in this respect. Measurements have been made on various borate, phosphate and phthalate solutions and indicate that the change in p_H between 30° to 90° (calculated on the assumption that the p_H of 0.1 N HCl is constant) is very small, compared with that of ordinary alkaline solutions. This is, of course, due to the fact that all owe their buffer action to the ionization of *acid* salts of some polyvalent acid. A phosphate buffer solution has been prepared which is *acid* at 30° and *alkaline* at 90°, although its p_H remains constant. Most indicators behave much like the buffer solutions, and hence a given color may indicate acidity at low temperatures and alkalinity at higher temperatures. The paper presents the results in graphical form.

Tracks of alpha particles in gases: R. W. RYAN and W. D. HARKINS.

The ferrocyanide test for zinc: R. D. MULLINIX and A. L. STALLBAUMER. Potassium ferrocyanide precipitates a white zinc ferrocyanide which, when treated with bromine water, turns a characteristic yellow color. No systematic work has been done to determine the best conditions for the test or to compare its sensitiveness with that of the hydrogen sulfide test. Such work has been done by the authors and leads to the following conclusions: (1) $K_4Fe(Cn)_6$ test for zinc is ten times as delicate as the H_2S test. 0.1 mg. of zinc ion in 50 c.c. of solution can be detected,

1.0 mg. is about the limit for the sulfide method. (2) The test should be carried out in a solution about one half normal with acetic acid and should contain ammonium salts. Warming to 60 aids flocculation. (3) The ferrocyanides of the alkaline earth metals are too soluble to interfere, other metal ions must be removed. (4) The yellow color with bromine water is also given by cadmium ferrocyanide.

Qualitative analysis without hydrogen sulfide: R. D. MULLINIX. G. Almkvist has proposed a method without the use of H_2S, but Na_2S followed by H_2SO_4. (*Zeit. anor. Chem.*, 103, 221-242, 1918). I have used for the past two years with qualitative classes a method in which, after the removal of the silver group by HCl, a mixture of NaOH, Na_2CO_3 and bromine water precipitates a group of hydroxides and carbonates, which are then further separated. The As, Sb, Sn, Pb traces, An, Al and Cr are in the filtrate. This is divided by HCl followed by NH_4OH, and zinc tested for in the presence of chromate and arsenate by the potassium ferrocyanide method. This is a preliminary communication and will be followed by more detailed work on the group analyses and end tests.

DIVISION OF SUGAR CHEMISTRY

S. J. Osborn, *chairman*
Frederick Bates, *secretary*

Detection of sugar in condensed waters by means of cresol: G. E. STEVENS. Fifteen ml. of cresol (U. S. P. Merck) is dissolved in a castile soap solution (6 gms. soap in 100 c.c. of distilled water). The mixture is warmed until a complete solution is obtained. This solution can be made up in litre quantities in the above proportions without deterioration. Approximately one inch of water to be examined is placed in a 6 inch by ⅝ inch test tube and five to ten drops of the cresol solution is added and then thoroughly mixed. Cool if the water is hot and then add concentrated sulfuric acid from a dispensing burette, holding the tube in an inclined position so that the acid will run down to the bottom and form a separate layer, and continue to add the acid until the acid layer is ¾ inch deep. The tube is then rolled between the palms of the hands and if sugar is present a reddish black to pink color ring will develop, the color depending upon the concentration of sugar in solution. A white translucent screen is recommended, to be placed between the eye and the source of light, such that the color reaction will be more easily recognized, especially in solutions containing very faint traces of sugar.

Hydrogen-ion determination as a method of refinery control. Preliminary report: H. Z. E. PERKINS. Direct control of acidity and alkalinity in sugar refining is obtained only at certain points, chiefly at beginning. After washing, sugar goes through main process of clarification, bone-black decolorization and crystallization without material change in ionization. By-products are unstable in composition, ferment quickly and are moreover treated with defecating agents, acid and alkaline. Ionization is variable, being resultant of several factors, natural and artificial. Main products, highly crystallizable, light in color, are easily tested with color indicators, but appear sluggish and uncertain with potentiometer. Lower products, dark colored, can not be used in color reactions, but respond better to electrometric tests. Figures are given showing variations and stability.

A study of the formation of gum levan from sucrose: W. L. OWEN. The formation of gum levan from sucrose by bacteria is not, as has been claimed by previous investigators, dependent upon its inversion and the utilization of invert sugar while in the nascent condition. Experiments on the production of gum levan in the presence of added invertase show that under these conditions it is decreased to the extent to which the invertase is active. The decrease is always greatest where the conditions are most favorable for invertase action. The optimum p_H for gum production is between 6.7 and 7.0, but the fermentation can proceed slowly where the p_H is 9.5. Under the latter conditions the addition of invertase does not reduce the production of levan by the bacteria.

The invertase value of the clerget constant: R. F. JACKSON.

A simple check valve: J. F. BREWSTER. A check valve for use with the water vacuum pump to prevent sucking back is made by cutting part way through a solid rubber stopper at the narrow end, leaving a thin flap or disk. The stopper is then bored to receive a piece of glass tubing, the flap being left intact. The valve stopper is inserted in a short length of glass tubing wide enough to allow free play of the valve. By means of a second one-hole stopper, glass and rubber tubing the valve is connected between the pump and the apparatus to be evacuated.

Some notes on activated vegetable chars: C. E. COATES. This article gives some data relative to the preparation and analysis of vegetable chars

from various sources. There are also given some tentative conclusions as to some of the underlying principles in the preparation of decolorizing chars.

The influence of borax on the polarizing power of mannitol: C. A. BROWNE.

The contraction in volume of sucrose solutions upon inversion: R. F. JACKSON.

The Vallez rotary filter press: W. D. HORNE. This newly introduced filter press differs from the preceding types of leaf presses in having its filtering discs set upon a hollow horizontal shaft which revolves slowly during filtration, insuring uniformity of deposit of cake upon the leaves. Paper pulp is used as the filtering medium, which gives greatly increased speed of filtration, while the uniformity of the cake allows of sweetening off with the minimum amount of water and gives a very low sucrose content in the washed cake. The washing out is particularly effective, and the arrangement of parts allows of very rapid discharging, cleansing and refilling.

Comparative color determinations in cane sirups and molasses: F. W. ZERBAN and S. BYALL. The object of this investigation was to ascertain whether it was possible with the Hess-Ives tint photometer to detect any difference in the specific transmissive index of cane products when the sample was in one instance dissolved in water and filtered with a small amount of kieselguhr, as previously practiced by the authors, and in the other diluted with white sugar sirup and filtered according to Peters' and Phelps' method. It was found, with twelve cane products representing the entire color range, that water dilution gave too low figures in 70 per cent. of the determinations, and too high figures in the remainder; the average difference was surprisingly small, —0.78 per cent. of the color for the red glass, —2.13 per cent. for the green glass and —6.28 per cent. for the blue glass. Only in a few individual determinations did the error due to water dilution exceed to any extent that attributable to the permissible error in the readings themselves. With the Hess-Ives instrument, therefore, the method previously used by the authors is sufficiently exact for practical factory purposes. Conditions are, of course, different when the spectrophotometer is used.

The countercurrent application of kelpchar in the decolorization of sugar and syrup: J. W. TURRENTINE. A process is described for the continuous, automatic and countercurrent application of kelpchar in the decolorization of sugar and other solutions and liquids. Use is made of the best filter practice, the process admitting of the employment of the most adaptable of modern filters. Thus vacuum or pressure filters or centrifugals may be employed, depending on the nature of the liquid to be filtered. The kelpchar by this process is admitted at one end of the apparatus, is applied countercurrent-wise to the liquid undergoing decolorization in as many applications as desired, and is discharged as spent cake; while the crude liquid is admitted at the end of the apparatus at which the spent cake is discharged and is delivered in a completely purified state at the other, upon entering the apparatus coming into contact with the practically spent carbon and finally before emerging undergoing treatment with the fresh kelpchar entering. In the one-stage application of a decolorizing carbon, the carbon first loads itself up with those impurities most easily removed, and finally adsorbs those least easily taken up. Thus an excess of the reagent is required, and at that an excess probably out of proportion to the decolorization to be effected. In the present system kelpchar that has been used to adsorb the impurities most difficult to remove is still available with unimpaired power to adsorb the impurities more easily adsorbed. In this way full use is made of the decolorizing properties of the kelpchar and the most efficient application of that material results. The advantages gained are that smaller quantities of kelpchar are in use and require reactivating and losses of values are correspondingly reduced. The process admits of continuous and automatic operation, and labor and laboratory supervision are reduced to a minimum.

Estimation of caramel in sugar products: A criticism of the Ehrlich method: G. P. MEADE. Ehrlich bases his method on the claim that saccharan, a component of caramel, is not precipitated by lead subacetate. The present investigation shows that this is true only with saccharan dissolved in distilled water; if any of the ordinary impurities are present that form a precipitate with lead the saccharan is carried down with the precipitate. Known amounts of saccharan and of caramel, added to molasses solutions, are largely removed by clarification with lead subacetate. Therefore, the Ehrlich method is valueless.

A steam-heated laboratory vacuum pan: J. F. BREWSTER. The body of the vacuum pan consists of an inverted bell jar with open wide neck fitted with a rubber stopper through which pass the leads of the 3/16 or 1/4 inch coil of copper tubing, the feed and drain-off pipes. A second